A Global Strategy
for the conservation and use of Coconut Genetic Resources
2018-2028

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cirad
LA RECHERCHE AGRONOMIQUE POUR LE DÉVELOPPEMENT

COGENT
Coconut genetic resources for enhanced livelihoods

Bioversity International

Version 6.1.2 was released on the COGENT website[38] along with an updated user manual in a downloadable pdf format.

At present, none of the COGENT databases available online includes the scientific literature relevant to coconut genetic resources. Such a database is maintained on a voluntary basis by Dr Hugh Harries as the Coconut Time line[39].

2.4.3 Geographic Information Systems.

A Geographic Information System (GIS) may be defined as "a database management system which can simultaneously handle spatial data in graphic form, i.e. maps, or the 'where', and related, logically-attached, non-spatial, attribute data, i.e. the labels and descriptions of the different areas within a map, or the 'what'."(Guarino et al. 2002). GIS technology has been increasingly used in genetic resources studies and conservation. For example, mapping collecting sites has allowed visualizing and extrapolating the distribution of targeted species, as well as locating areas of higher genetic diversity, and areas that are under-represented in conservation or threatened with genetic erosion or global change. Thus, in Vietnam, GIS technology has been used to manage a database of coconut palms selected in farmers' fields, for producing planting material, and to evaluate the effects of climate change in the Mekong Basin through the National Coconut Project led by the Institute for Oils and Oil Plants.

Between 1995 and 2012, coconut researchers from 13 COGENT countries were trained for inputting data into the CGRD, subsequently allowing geo-referencing 60% of the CGRD accessions. In 2013, CIRAD collaborated with COGENT and the CRP-FTA to assess this and other information, and to map global coconut distribution. The localization of all collection sites was systematically checked, significantly improving the quality of COGENT data. Coconut global distribution has been studied using Ecoclimatic Niche Modelling. The resulting maps provide a clearer picture of potential coconut cultivation areas (Figure 2.5), contribute to our understanding of coconut dispersal, and allow a better identification of collecting gaps (under-represented in international collections, see Figure 2.6). This new tool will also be useful for anticipating the effects of climate and sea-level changes. From this perspective, an effort has been recently undertaken to map regions of particular genetic diversity.

Figure 2.5 presents climate suitability for coconut. Dark green indicates marginal areas, while light green and warmer colours are used for increasingly favourable areas. Highly favourable climates are best represented in the Pacific and Indian oceanic regions (Southern Asia to Australia, Eastern Africa and Madagascar, and myriad small tropical islands), corresponding to the natural distribution of the species (Batugal et al. 2005b). Favourable climates are also found in the Gulf of Guinea, the coasts of eastern Brazil and the Guyanas, in all the Caribbean, (where the coconut was introduced in historic times), and in the Pacific coasts of Colombia and Panamá (where the coconut was introduced in Pre-Columbian times).

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[38] See URL: http://www.cogentnetwork.org/cgrd-version-6-0-test-version

[39] See URL : http://cocos.arecaceae.com/

The climatic model also suggests some inland areas, as in the basins of the Amazon and the Congo, where coconut is rare, or only recently introduced.

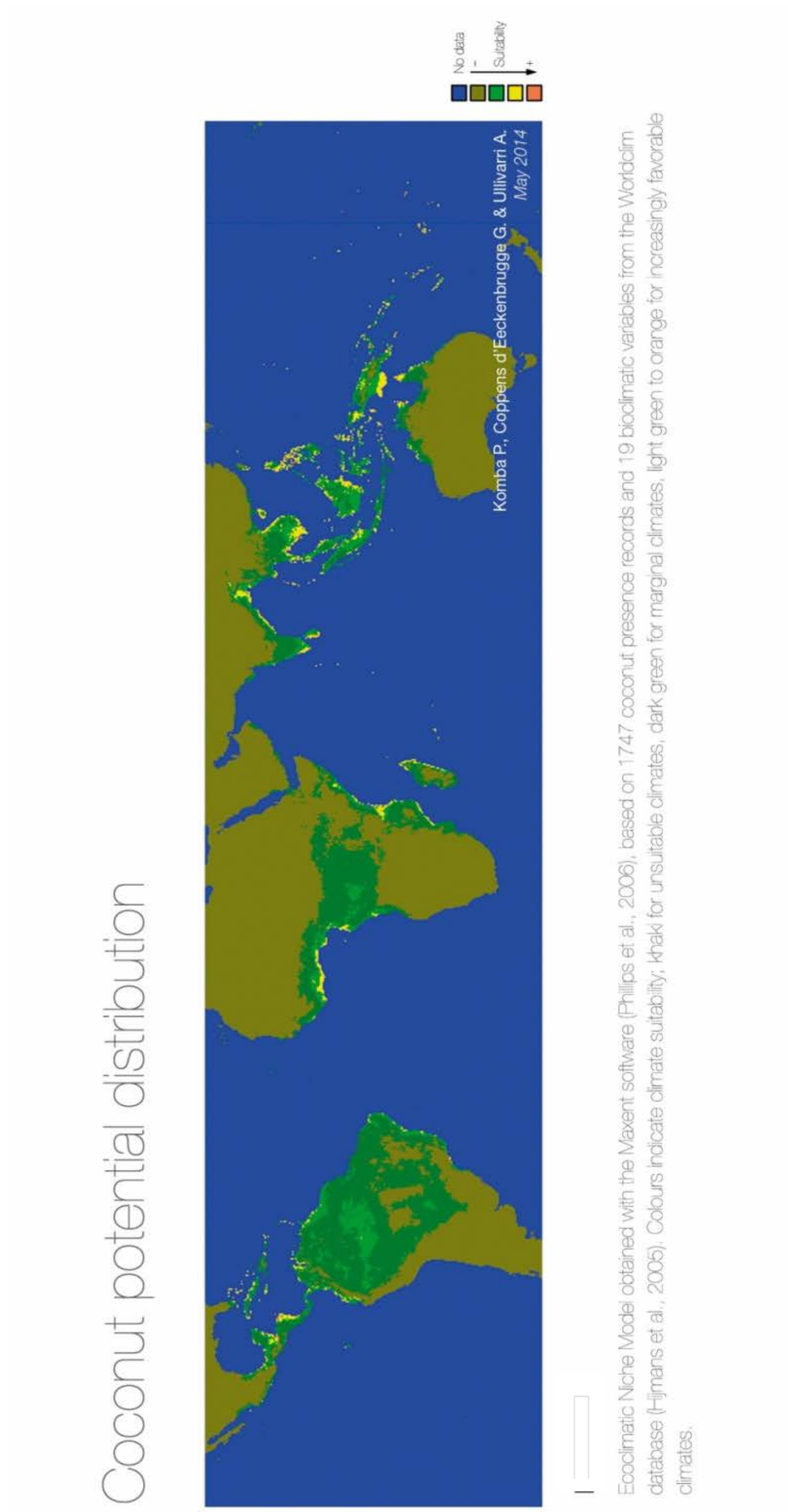

Figure 2.5. Ecoclimatic niche model for coconuts

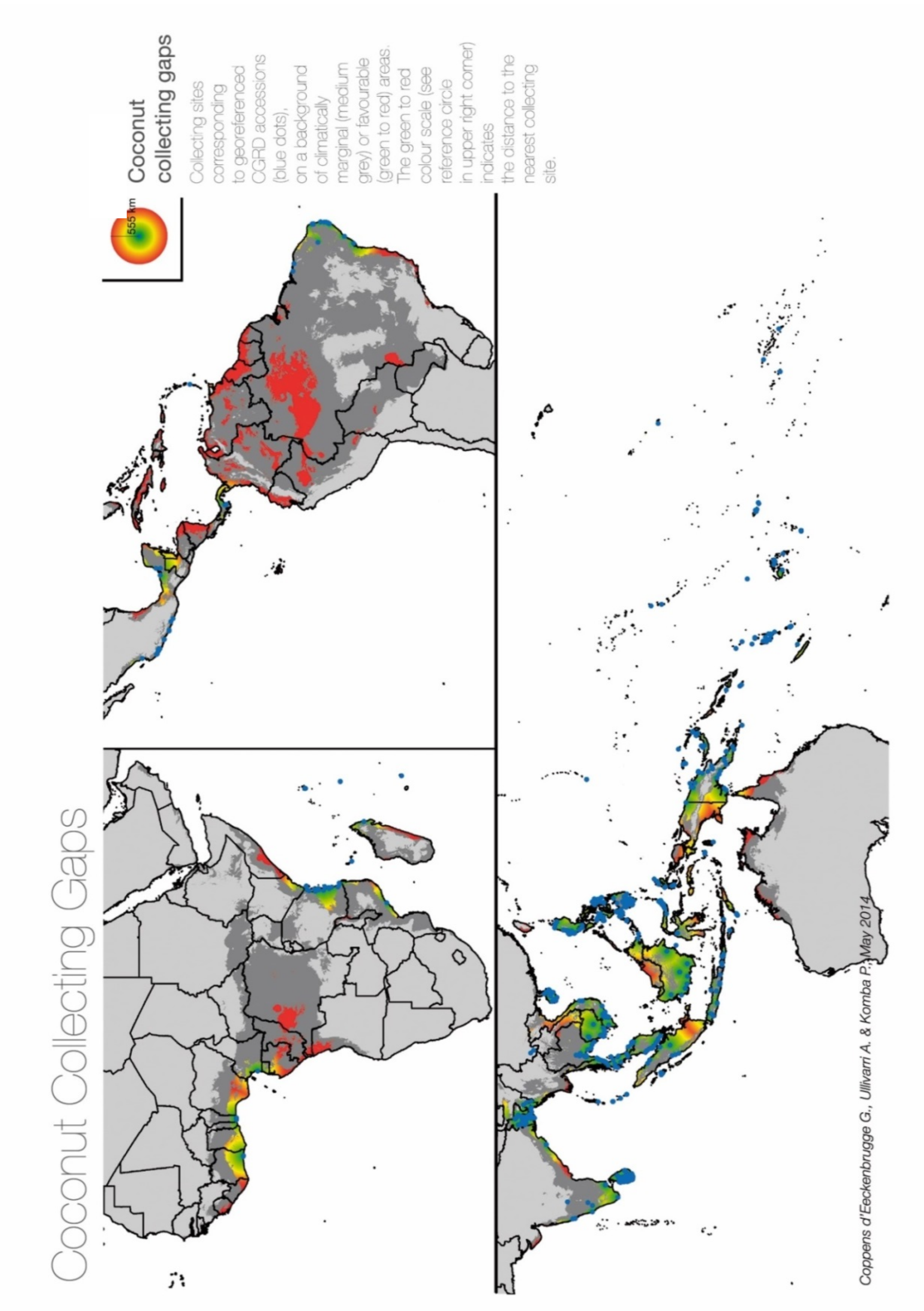

Figure 2.6. Coconut collecting gaps

Figure 2.6 (former page) presents the geographic origin of coconut germplasm held in the international collections under the aegis of COGENT. The Indo-Pacific region has been relatively densely sampled. However, there are important collecting gaps along the northern coasts of Australia, several areas in Indonesia, northern Viet Nam, the Indian coast, southern Somalia, and eastern Madagascar. Western Africa has been poorly explored, particularly south of the Gulf of Guinea. Similarly, in the neotropics, germplasm from the Caribbean coasts, Gulf of Mexico, northern South America and the equatorial Pacific are very poorly represented in the international collections.

Remote sensing analysis is the most cost-effective way to precisely map cultivated areas and inventory coconut resources. Coconut palms are easily recognisable in satellite images and can be counted with adapted field controls. Such an approach was developed in French Polynesia (Teina et al. 2008, Desmier et al. 2011) and in Kiribati (Forstreuter 2013). With the support of GIZ the same resource-mapping exercise is in progress for Tuvalu[40]. Multi-temporal aerial photographs and high-resolution satellite images are also used to assess shoreline changes, coastal erosion and flooding, especially in low atolls such as Tuvalu (Ford 2013) and Marshall Islands (Duvat et al. 2013).

In 2008, a process-based dynamic simulation model for coconut was developed and validated for different agro-climatic zones of India (Kumar et al. 2008). This model is being used to anticipate the impact of climate change (Kumar et al. 2013). Simulation analysis has indicated that agronomic adaptations such as soil-moisture conservation, summer irrigation, drip irrigation, and fertilizer application may not only minimise losses in the majority of coconut growing regions, but may also substantially improve productivity. In India, implementing such strategies could increase productivity by 25–32% by 2050 to 2080, depending on the climate scenario (Figure 2.7).

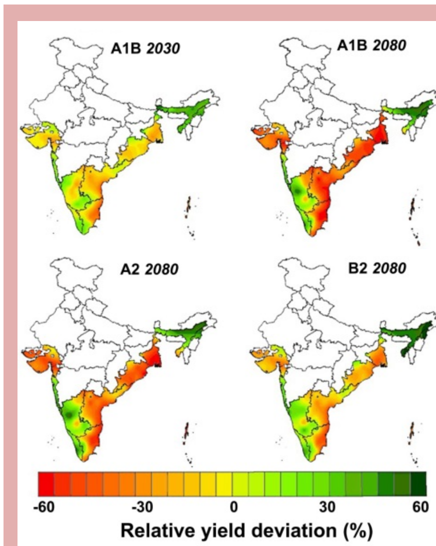

Figure 2.7. Future coconut productivity under different models of climate change. (from Kumar and Aggarwal 2013)

2.5 Utilization of coconut genetic resources

As mentioned earlier, the future of the world coconut economy depends significantly on the conservation and sustainable use of genetic resources. Compared to other crops, there has been limited investment in scientific research aimed at improving coconut productivity and quality, and only a limited number of professional breeders are involved in coconut breeding.

Although evaluation of collections and farmers' selections has shown wide variation for yield, disease resistance and quality, most of the planting material used by farmers

[40] Available from the URL: http://www.sopac.org/index.php/media-releases/1-latest-news/464-keynote-address-dr-russell-howorth-2012-pacific-gisrs-conference